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considers the institute's youth, is the fact emphasized on an earlier anniversary by Mr. Augustus Lowell and expressed by him in the phrase, "The M. I. T. is *pre-eminently a leader in education*." Its educational ideals and methods have been studied and almost everywhere the trend to-day is in the direction in which the institute has long been moving.

To celebrate the fiftieth anniversary of the granting of the institute's charter a congress of technology has been arranged. At this congress, which opens to-day, and will be in full activity to-morrow, prominent alumni and members of the faculty are to deal with problems raised in the field of their own specialty. The guiding idea throughout is the gain in efficiency that comes from the application of scientific methods to the treatment of the great practical problems of the day. The business world must be weary of amateur suggestions for the conduct of its affairs and there is danger of damage to a great cause by too much talk. The problem of increased efficiency is no new problem to the man of affairs, and there is much that is thrust upon him in these days that he must have known for years. On the other hand, a sane and serious discussion by men who know their subject and speak from experience must always be welcome, and doubtless in the proceedings of this congress there will be much of interest to the business men who are alive to the necessity of advancement and who are on the alert for suggestions that may be helpful in their own affairs.

A glance at the program will give some idea of the variety of the interests represented, but more thorough study is needed to realize in any adequate measure that the work of this institute touches practical life at a thousand points. What the institute has achieved in half a century has fully

justified Rogers's statements when making his first appeal for public support. "I am sure," he said, "that I speak from no impulse of mere enthusiasm when I say that this new undertaking presents an opportunity of practical beneficence in connection with education which is not only peculiar, but without precedent in this country. My experience as a teacher and my reflections on the needs and means of industrial instruction assure me that this enterprise, when fully understood, must command the liberal sympathy of those who aim to make their generosity fruitful in substantial and enduring public good."

R. C. MACLAURIN

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HENRY PICKERING BOWDITCH

DR. BOWDITCH was one of the foremost leaders in the scientific development of America. In the establishment of university laboratories for research he was a pioneer and for forty years he exerted a wide and profound influence upon the progress of physiology, of medical science and of university education. It was the man himself which counted, for upon every one his sincerity, his absolute single-mindedness, his intellectual power and his genial spirit made a lasting impression, and created confidence in himself.

Bowditch was born April 4, 1840, at Boston. He descended from the best New England stock. Nathaniel Bowditch, the mathematician, well known to all navigators, was his grandfather. His father was a successful business man, who bought a large estate at Jamaica Plain, upon a beautiful hill, which has a commanding view both of Boston and of the country for many miles around. This hill is intimately associated with Dr. Bowditch in the thought of all who knew him, for he continued as one of a large family colony to dwell on it until his death.

He entered Harvard College, graduated in 1861, and entered the Lawrence Scientific School, but in November of that year he volunteered and became a second lieutenant in

the First Massachusetts Cavalry. His regiment went south in January, 1862, and from that time until the close of the civil war he was almost continually in active service. He resigned June 3, 1865, being then major of the Fifth Massachusetts Cavalry. He reentered the scientific school, and passed from there to the Harvard Medical School, from which he received the degree of M.D. in 1868. He frequently referred with gratitude to the influence of Jeffries Wyman upon his own scientific development.

With the approval and encouragement of his father he decided to devote himself to a scientific career, and as it was impossible to obtain satisfactory training in medical science at that time in this country, he went to Europe to study in Paris, Bonn and Leipzig. At the latter place he worked under Carl Ludwig, of whom he always spoke with reverence and affection. The great master found an apt pupil in the young American, and the pupil rapidly became a master himself. Bowditch had remarkable mechanical talents. Ludwig was wont to tell how Bowditch arrived in the laboratory when the kymographion invented by Ludwig was beginning to be used, and the automatic record showed only the movement of the muscle or heart, the time of stimulation being marked by hand. Bowditch immediately set to work and produced the devices for recording the actual time and the duration of the stimulus automatically. Many valuable ideas are simple, like Bowditch's invention, and after they have been produced appear obvious and invaluable, but in reality lucid simplicity is one of the essential characteristics of a superior intellect. Bowditch was endowed with this quality in a high degree, and it showed itself throughout his life in the perfection with which he worked out the problems he had to deal with. In Ludwig's laboratory he carried through his researches on the heart, which were of fundamental importance and therefore rank among the cherished classics of physiology.

He remained abroad until 1871, returning to Boston in September of that year to become assistant professor of physiology at the Har-

vard Medical School. Up to 1871 Dr. Oliver Wendell Holmes had lectured on anatomy and physiology, thereafter the professorship was divided. Holmes restricted himself to anatomy. Physiology was assigned to Bowditch. In 1876 he was made full professor. In 1906 he resigned his position owing to failing health, and was made professor emeritus. He met the increasing limitations of his illness with perfect courage. Courage was one factor of his power over others. Death came quietly on March thirteenth last.

The Harvard Physiological Laboratory was the first modern laboratory for instruction and research in the medical sciences to be founded in America. It was wonderfully equipped for the period of its foundation, for Bowditch put into the laboratory the large supply of apparatus, his personal property, which he had brought back from Europe. He at once began a course of lectures in physiology, which excelled so enormously anything which had ever been presented in America, that the effect was instantaneous. The consequences were revolutionary, for his work at Harvard initiated the creation of the new medical standards. The present writer was his first research pupil and recalls vividly the revelation opened by admission to the new laboratory.

During thirty-five years Bowditch was an efficient leader in the development of the Harvard Medical School, in the advancement of physiology and other medical sciences in the United States, and he found time besides to promote energetically many causes of civic betterment. Very few men have contributed so much as he to the elevation of medical education. He stood for the highest ideals of progress and maintained always that the old-fashioned "practical" physicians must be replaced by men scientifically trained and animated by the scientific spirit. For this principle he carried on a long campaign. In the face of opposition and much early discouragement he kept steadily at this great task, and had the satisfaction in the end of seeing his cause triumphant. The superiority of the laboratories abroad, especially in Germany a generation since, made a profound impression

on American students. Bowditch was one of a group of young physicians who strove successfully to found at Harvard laboratories modelled on those of Germany. The result of their efforts was the medical school building on Boylston Street, which, when it was dedicated in 1883 was easily the best for its purposes in America. From the time of the opening of this building until 1893 Bowditch acted as dean of the medical school, and during this period the school improved with unparalleled rapidity largely owing to his personal influence. He was a man who had visions of better conditions, and worked to make them realities. It was his vision which first conceived a second new medical school on a magnificent scale of equipment, and it was mainly by his persuasion that the Harvard authorities agreed to attempt to carry out the plan. He threw himself with characteristic ardor into the work. Together with Dr. John Collins Warren and others he labored, and the magnificent laboratories, opened in 1906, which the school now possesses, commemorate his devotion and success. With the completion of the cluster of five hospitals at present under actual construction or soon to be begun, which will surround the laboratories, Bowditch's dream will be fulfilled. Fortunately he lived to know that this fulfilment was assured, though he could not see it completed.

Outside causes, sometimes professional, sometimes civic, often appealed to him. Thus he was one of the principal founders of the American Physiological Society, to the affairs of which, as of the National Academy and other scientific associations, including the International Physiological Triennial Congresses, he gave of his time generously and always helpfully. With a small group of colleagues in Boston he took up psychical research, and aided in founding and for several years in managing the American society. His open-mindedness was shown in this matter and was characteristic, but his experience finally rendered him extremely skeptical as to the reality of telepathy and other alleged psychical phenomena. He was a trustee of the Elizabeth Thompson Science Fund from its

foundation in 1886 until 1906. Much of the credit of the success of that fund belongs to him. In Boston he served several years on the school committee, and also as a trustee of the Public Library. Whatever he undertook he tried to do well and with such complete singleness of purpose that every one with whom he was thrown in contact instinctively trusted him.

The manifold activities, which have been referred to, encroached upon his time, and in later years he occasionally asked a friend whether his life would not have been of greater service, if he had devoted himself exclusively to experimental physiology. His success in more extended research would have been great, for in all his actual researches he was eminently successful. Thus, his work on the growth of children remains still the best on the subject. His investigations on the indefatigability of nerves, on the knee-jerk, on ciliary motion and other subjects are important and are also models both of thoroughness of experimentation and of clearness of presentation. Nevertheless, one must reply to Bowditch's own question that his life was well and wisely spent, as measured by the value of his services to the general welfare. In view of his great efficiency in promoting not only physiology but science in general and in elevating medical teaching, we must admire with grateful appreciation his career, which has been a powerful factor in the advance of research and education in America.

His own researches only partially indicate his range and efficiency as an investigator, to measure which fully one must know the work of William James, Stanley Hall, Southard, Lombard, Porter, Cannon and many others, who worked in his laboratory.

He received many tokens, both personal and official, of the high esteem in which he was held. He was an honorary member of numerous scientific bodies, and received honorary degrees from Edinburgh, Cambridge (England), Toronto, the University of Pennsylvania and his own Harvard.

Dr. Bowditch married Miss Knauth in 1871. She was the daughter of a Leipzig banker,

whose house was the center of delightful hospitality to many Americans, studying at Leipzig. He found great happiness in his home life, in his children and grandchildren, and also in the numerous friends, whom he attached not only by his unusual abilities but by his personal charm. He was social by nature, keenly humorous, warm and faithful in his attachments, full of the zest of life. He was profoundly modest and seemed never to know how high his abilities were estimated by others. He never quarrelled, but was for every good cause he championed a good fighter. Perhaps his most distinguishing trait was his remarkable combination of keen practical sense in the use of means with enthusiasm in the pursuit of ideal aims. With all his buoyant vitality, with all his eager interest in men and affairs, he was essentially an idealist, who won the love and admiration of many friends both in Europe and America.

C. S. MINOT

#### *SAMUEL FRANKLIN EMMONS*

THE death of Samuel Franklin Emmons at his home in Washington, D. C., on March 28, 1911, after an illness lasting only five days, removed from the ranks of American economic geologists the one who, by virtue of his influence on the progress of his branch of science and by his long and illustrious service, worthily stood at their head. For the last few years Mr. Emmons's increasing infirmity had given concern to his friends, but his own cheerfulness and serenity were unaffected by bodily weakness and when his colleagues missed him from his desk at the Geological Survey offices during the few days before his death they believed merely that a cold in conjunction with unseasonable weather confined him to his house. None foreboded the fatal ending of his illness.

Born on March 29, 1841, in Boston, Mass., the home of his ancestors since 1640, Mr. Emmons at his death lacked one day of his seventieth year. His great-grandfather, Samuel Franklin, after whom he was named, was a first cousin and close friend of Benjamin Franklin.

Mr. Emmons graduated from Harvard College in 1861 and went abroad to continue his studies, first at the *École Impériale des Mines* in Paris and afterwards at the *Bergakademie* in Freiberg, Saxony. He returned to the United States in 1866 and after spending eight months in visiting the mining districts of the west he joined Clarence King as a volunteer assistant in the United States Geological Exploration of the fortieth parallel, receiving his official appointment in the winter of 1867-8. For nearly ten years he remained with this organization, seeing varied service, gaining that wide knowledge of the geology of the west that he afterwards turned to such good use, and contributing to the published results of the exploration. With Mr. Arnold Hague he was joint author of the second volume of the great fortieth parallel series, entitled "Descriptive Geology" and he had a part also in the preparation of Volume III., "Mining Industry." His work carried him to Virginia City in the winter of 1867-8; to Mono Lake in March, 1868; to the unknown mountain ranges of central and eastern Nevada and of western Utah in the following summer; to the Wasatch Range and to the region adjacent to Great Salt Lake in 1869; to Mount Rainier in 1870, and to the Uinta Mountains in 1871 and 1872.

Having accomplished his duties in connection with the fortieth parallel survey, Mr. Emmons, in the autumn of 1877, returned to the west and engaged in the then stirring business of raising cattle, near Cheyenne, Wyoming. When, however, Clarence King in 1879 organized the United States Geological Survey and became its first director, he sought out his friend and associate of earlier years and placed Mr. Emmons in charge of the economic geology of the Rocky Mountain division with instructions to make a detailed survey of the newly opened Leadville district. During the field-work at Leadville, which lasted until 1881, Mr. Emmons collected the statistics of the precious metals in the Rocky Mountains for the Tenth Census and in Volume XIII. ("Precious Metals") of that publication, jointly with Dr. George F. Becker,